



Online Monitoring and Control

BIOPROCESS SOLUTIONS



a xylem brand

Life Sciences
Data for Life.™



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Thank you for considering YSI as your supplier of bioprocess monitoring and control solutions. As increasing consumer and regulatory demands mandate the need for safe, efficacious, low-cost biologically-derived products, it is imperative that robust, cost-effective manufacturing processes are developed for meeting the global demands of biopharmaceutical, biofuel and other industrial biotechnology commodities.

With over 40 years of providing rapid, accurate bio-analytical instruments, YSI Life Sciences has established a legacy of expertise in various industrial applications, including bioprocess monitoring and control. Our online monitoring and control solutions have been designed to help make your job easier, increase your process knowledge and improve your process efficiency.

YSI Life Sciences is here to support you. Our knowledgeable customer service and technical support staff can help with any instrument or application questions you may have.

Thank you for your interest in YSI and for reviewing our catalogue. Please contact us with any questions, comments or concerns. Your input is highly valued.

A handwritten signature in white ink, appearing to read 'Chris Warner'.

Christopher Warner
YSI Life Sciences, Assistant Product Manager



Monitoring & Control

bioprocess



2900M

Applications

Cell Culture
Fermentation
Cell Therapy
Process R&D
Process Optimization
Design of Experiments
Continuous Processing
cGMP Manufacturing



2950M

2900M

Monitor 1 vessel
Analyze up to 2 chemistries

2950M

Monitor 1 vessel
Analyze up to 6 chemistries



2940/2980

2940

Monitor 4 vessels
Analyze up to 6 chemistries

2980

Monitor 8 vessels
Analyze up to 6 chemistries

OPC Connectivity

2920 OPC Data Manager
2925 OPC Software

Features at a Glance

Automated Bioreactor Sampling. Fully automated around-the-clock process monitoring

Near Real-time Analysis. YSI's innovative biosensor technology and online monitoring systems assure rapid, accurate measurements of critical nutrients and metabolites in near real-time.

Aseptic Operation. YSI monitoring systems ensure bioreactor sanitary environment is maintained through automated system sanitization and microfiltration sampling probes.

Flexibility. Interfaces with virtually any bioreactor size or type, including single-use systems.

Scalability. Scale-independent technology allows you to seamlessly scale-up your unit of operations, regardless of bioreactor size.

Connectivity. Connect to any bioreactor controller, SCADA, DAS or LIMS via analog (0-5V), serial (RS-232), ethernet or OPC communication.

Data Management. Intuitive user interface allows various graphical displays, data download and acquisition options and remote data access.

Feed Control. Online control of nutrients can be achieved with YSI's monitoring systems by direct communication to a feed pump, bioreactor feed control system or SCADA.

21 CFR, Part 11 Compliance. Assures FDA regulatory compliance for electronic records.

2900M/2950M

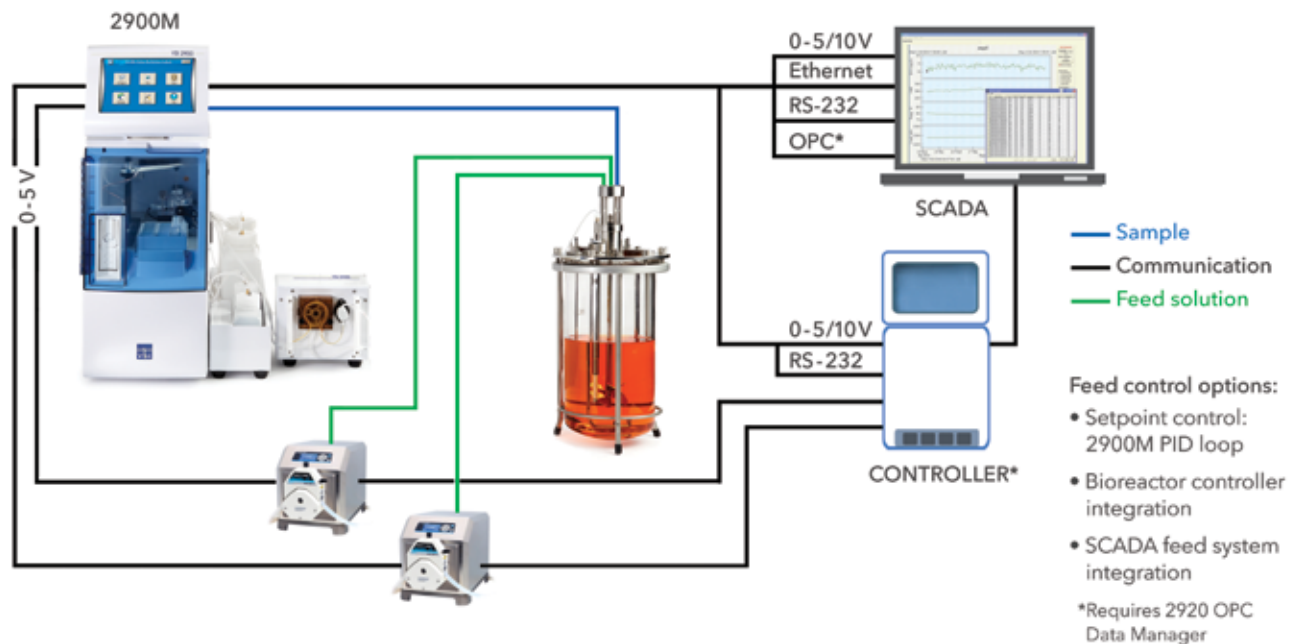
Online Monitoring & Control Systems

Our single-vessel sampling systems are designed to provide simple and reliable online monitoring and control solutions for your bioreactor process. Closed-loop monitoring and control capability are easily achieved for any scale of operation or type of bioreactor.

YSI 2900M/2950M

- Monitor up to 6 chemistries
- Analytical results in 60 seconds per chemistry
- Touchscreen, icon-driven HMI for easy viewing and menu navigation
- Simultaneous online monitoring and 96-well plate sampling
- Connectivity options for SCADA, DAS or LIMS
- Direct control of up to 2 feed pumps
- Automated cleaning cycle
- Autoclaveable components
- CIP and SIP compatible
- 21 CFR, Part 11 compliant
- GAMP® 5 compliant

Multiple Connectivity Options Include RS232, Analog (0-5V), Ethernet and OPC





2900M/2950M Specifications

Aspirated Sample Volume: User-defined from 10 to 50 μ l

Analysis Time: 60 seconds

Precision: Application specific, typical CV <2%

Linearity: +/- 5% Cal value to maximum

Dimensions: YSI 2900: 8" w x 20.5" d x 15.75" h | 20.3cm w x 52.1cm d x 40cm h
 YSI 2950: 14" w x 20.5" d x 15.75" h | 35.6cm w x 52.1cm d x 40cm h
 Bottle rack adds 9" (22.9cm)

Weight: YSI 2900: 28lbs/12.7kg | YSI 2950: 39lbs/17.7kg (without bottle rack)

Working Environment: 15 to 35° C ambient temperature
 10 to 75% relative humidity (noncondensing)

Power Requirements: 100 - 120 VAC or 220 - 240 VAC, 50 - 60 Hz, 50 Watts nominal

Regulatory Compliance: CE, RoHS

Automation: Up to 96 samples

21 CFR, Part 11: Compliant

2960 Online Monitor Specifications

Vessel Inputs: 1-channel Autosampler: 1 input

Dimensions: 6.25" l x 4.75" w x 5.50" h

Weight: 3lbs

Power Requirements: 90 - 264 VAC, 1.5 A, 47 - 63 Hz, 30 Watts nominal

Regulatory Compliance: CE, RoHS

Sample Flow Rate: 0.1 - 2.5 ml/min (user defined)

Sample Purge Time: 30 seconds minimum recommended (user defined)

Sample Interval: Time unit: minutes (user defined)

Vessel Tubing Length: Maximum recommended length is 3 meters (10 feet)

Antiseptic Cycle: Time unit: minutes (user defined)

Tubing ID: Sample inlet: 0.020"
 Peristaltic pump: 0.035"
 Pinch valve: 0.03"
 Waste: 0.10"

Tubing Wetted Materials: Pharmed® tubing (peristaltic pump)
 C-flex® tubing (pinch valve)
 Silicone (sample inlet and waste lines)

I/O Communication Interface Specifications

Ethernet (FTP): 1 port

OPC: 1 port (2920 OPC Data Manager Module required)

Serial Communication (RS-232): 1 port

Analog (0-5/10V): Selectable: +10.0 VDC or +5.0 VDC
 Capable of communicating up to 2 chemistries/vessel

USB: 1 port

Parameters

Glucose
 Lactate
 Glutamate
 Glutamine
 Galactose
 Lactose
 Sucrose
 Xylose
 Choline
 Ethanol
 Methanol
 Hydrogen Peroxide
 Ammonium*
 Potassium*

*2950M only

2940/2980

Multi-Channel Online Monitoring Systems

For multiple and parallel bioreactor systems, our 4-channel and 8-channel sampling systems provide many simple and reliable online monitoring and control solutions for your bioreactor processes. Closed-loop monitoring and control capabilities are easily achieved for any scale of operation or type of bioreactor, including single-use systems.

YSI 2940/YSI 2980

- Automated, aseptic sampling of up to 8 vessels
- Monitor up to 6 chemistries
- Analytical results in 60 seconds for each chemistry
- Simultaneous online monitoring and 96-well plate sampling
- Automated cleaning cycle
- Autoclaveable components
- CIP and SIP compatible
- Touchscreen, icon-driven HMI for easy viewing and menu navigation
- Connectivity options for SCADA, DAS, LIMS and feed-control systems
- Remote access and control via web-based server
- OPC server option
- 21 CFR, Part 11 compliant

Multiple Connectivity Options Include Analog (0-5V), Ethernet and OPC

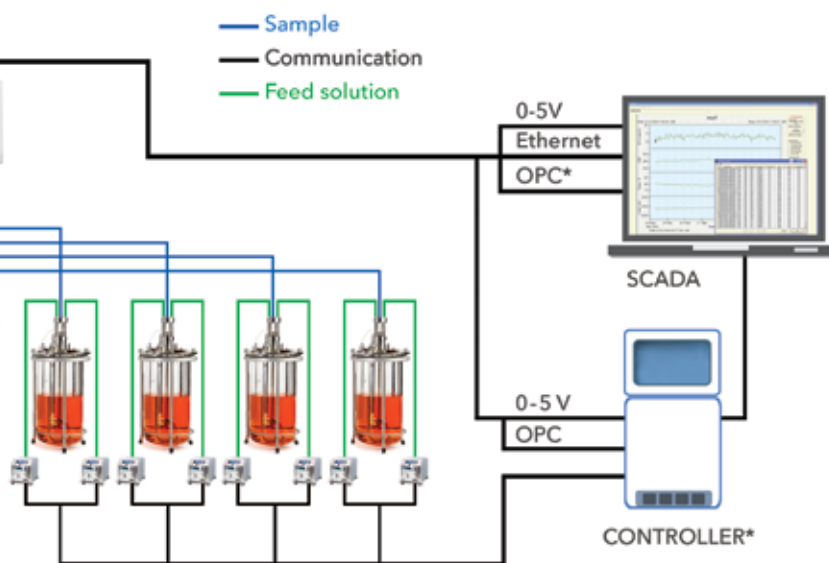
2900/2940



Feed control options:

- Bioreactor controller integration
- SCADA feed system integration

*Requires 2925 OPC server software





2900/2950 Biochemistry Analyzer Specifications

Aspirated Sample Volume: User-defined from 10 to 50 μ l

Analysis Time: 60 seconds

Precision: Application specific, typical CV <2%

Linearity: +/- 5% Cal value to maximum

Dimensions: YSI 2900: 8" w x 20.5" d x 15.75" h | 20.3cm w x 52.1cm d x 40cm h
 YSI 2950: 14" w x 20.5" d x 15.75" h | 35.6cm w x 52.1cm d x 40cm h
 Bottle rack adds 9" (22.9cm)

Weight: YSI 2900: 28lbs/12.7kg | YSI 2950: 39lbs/17.7kg (without bottle rack)

Working Environment: 15 to 35° C ambient temperature
 10 to 75% relative humidity (noncondensing)

Power Requirements: 100 - 120 VAC or 220 - 240 VAC, 50 - 60 Hz, 50 Watts nominal

Regulatory Compliance: CE, RoHS

Automation: Up to 96 samples

21 CFR, Part 11: Compliant

2940/2980 Online Monitor Systems Specifications

Vessel Inputs: 2940: 4 vessel inputs
 2980: 8 vessel inputs

Dimensions: 15.2cm w x 46.2cm h x 27.9cm l (6" w x 18.2" h x 11.0" l)

Weight: 7.26kg (16lbs)

External Power Requirements: Auto-sensing power adapter: 100 - 120 VAC/220 - 240 VAC,
 1.5 A (50/60 Hz \pm 5%)

Regulatory Compliance: CE, ETL, UL, RoHS

Sample Size: 0.5 - 2ml (user defined)

Sample Flow Rate: 0.1 - 2.5ml/min (user defined)

Sample Interval: Time unit: minutes (user defined)

Antiseptic Cycle: User defined flow rate (ml/minute) and time (minutes)

Vessel Tubing Length: 1.5 meters (5 ft) (autoclavable and gamma irradiated options)
 3 meters (10 ft) (autoclavable and gamma irradiated options)

Tubing ID: Sample inlet: 0.030"
 Peristaltic pump: 0.030"
 Waste: 0.0625"

Wetted Materials: Pharmed® tubing (peristaltic pump)
 C-flex® and C-flex Ultra® tubing (sample inlet and waste lines)
 PBT (Sample Manifold)
 Nylon (connectors)

I/O Communication Interface Specifications

Ethernet (TCP/IP): 2 ports (additional ports if Ethernet hub is used)

OPC: 2 ports (additional ports if Ethernet hub is used)

Analog (+5.0 VDC): 2940 - 4 ports (1 port per vessel)
 2940 - 8 ports (1 port per vessel)
 Each port capable of communicating up to 2 chemistries

USB: 4 ports

Parameters

Glucose
 Lactate
 Glutamate
 Glutamine
 Galactose
 Lactose
 Sucrose
 Xylose
 Choline
 Ethanol
 Methanol
 Hydrogen Peroxide
 Ammonium*
 Potassium*

*2950 only

FISP®

Bioreactor Sampling Probes

YSI proudly offers Flownamics FISP® *in-situ* Sampling Probes as part of our online monitoring systems. FISP sampling probes have been the standard *in-situ* bioreactor and vessel sampling device for over 20 years. Employing ceramic microfiltration technology, FISP sampling probes provide simple, cell-free sampling while ensuring bioreactor or fermentor sterility. FISP sampling probes are available in a variety of sizes to fit most types of bioreactors, including single-use vessels.

FISP Features

- Aseptic, cell-free vessel sampling
- 0.2 micron filter assures vessel sterile barrier
- Wetted materials provide excellent chemical resistance
- SIP/CIP/Autoclave compatible
- Minimal dead volume provides consistent, accurate sampling
- Resistant to temperatures, pressures, viscosities and shear forces
- For use in lab, pilot and industrial scale vessels
- Compatible with bacterial, yeast, fungal, algal and mammalian cell culture processes
- Animal-derived component free (ADCF) wetted materials
- Membrane meets ISO 10993:5, *in vitro* Cell Cytotoxicity, requirements



F-series FISP Probe

- Fits 12 & 19mm headplate ports
- Dead volume 0.24 - 0.44ml, depending on probe length
- Immersion lengths (mm): 120, 200, 310, 410
- Can be used with single-use bioreactors
- Can be used with 1.5 and 2 inch sanitary fitting ports (adapter required)



D-Series FISP Probe

- Fits standard and safety 25mm Ingold ports
- Dead volume 0.24 - 0.44ml, depending on probe length
- Immersion lengths (mm): 90 (standard) & 115 (safety port)

2920 OPC Data Manager

2925 OPC Server

YSI's OPC data management technology seamlessly acquires data from both off-line and on-line YSI analyzers and exports your data into any OPC-enabled SCADA, bioprocess management system or data historian. Our OPC Data Manager and OPC-enabled online monitoring systems feature an internal web server, which allows easy remote access using a web browser. Whether you are networking a single bioreactor system, an entire PD lab or multiple labs or suites, YSI's OPC data management options provide simple connectivity and data management solutions for your process systems.

2920 OPC Data Manager

- Add-on module for off-line YSI 2900 Series biochemistry analyzers or YSI 2900M/2950M Online Monitoring & Control Systems
- Fully compliant OPC DA (Data Access), v.1.0 and 2.0
- OPC Server only, communicates to OPC-enabled systems with OPC Client
- Exports data into any OPC-enabled system
- Internal web server
- Remote access using IP address and web browser
- Performs extensive error tracking and management
- Sleek, modular design
- Includes YSI 2925 OPC Server Software

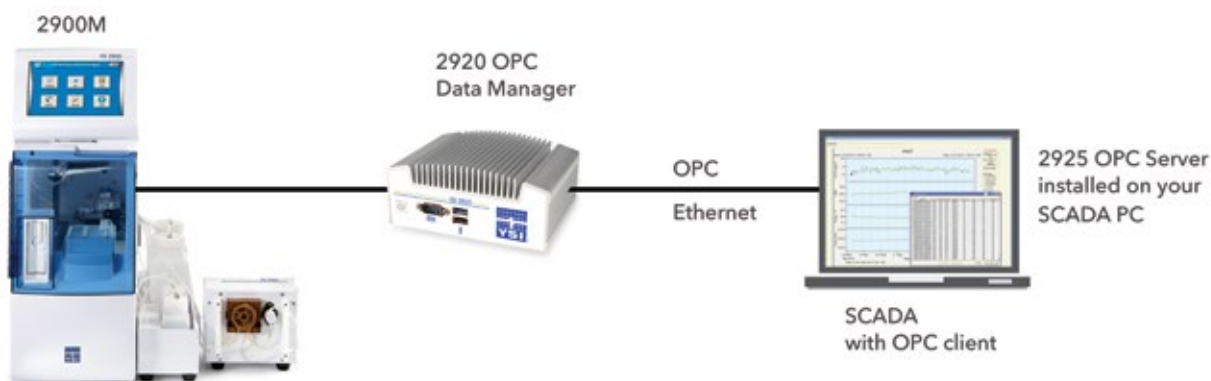
2925 OPC Server Software

- Software option for YSI 2940 and YSI 2980 only
- Allows same OPC functionality as YSI 2920 OPC Data Manager

YSI OPC Server System Requirements

- OS: Windows 7, 32/64 bit
- Ethernet connectivity
- 512 MB RAM
- 10 MB of available hard disk space
- CD-ROM driver
- Mouse pointing device

YSI OPC Connectivity and Systems Integration



Questionnaire

CUSTOMER INFORMATION

Name _____
Company _____
Email _____
Phone _____

PROCESS INFORMATION

1. Type of bioreactor process:

Animal Cell Culture Insect Cell Culture
 Suspension Cell Culture Bacterial Fermentation
 Yeast Fermentation
 Fungal/Filamentous Bacterial Fermentation
 Continuous Process Other

2. Cultivation Method:

Batch Perfusion Fed Batch Chemostat Other

3. Process Duration:

≤ 24 hours 2 - 7 Days 1 - 2 Weeks
 2 - 4 Weeks > 4 Weeks

4. Process Working Volume:

≤ 500 ml 500 ml - 1 L 2 - 5 L 6 - 10 L
 11 - 50 L 51 - 200 L > 200 L Other

5. Process Operating Pressure:

_____ psi/bar

6. Fermentation/Cell Culture Media:

Chemically Defined Complex Other

7. Maximum Cell Density:

OD/AU Dry Cell Weight Wet Cell Weight cells/ml

8. What is the viscosity of your culture/fermentation?

≤ 1000 centipoise (cP) 1000 - 3000 cP Other

9. Fermentation/Cell Culture Product Information:

Intracellular Secreted

If secreted, what is the molecular entity? _____

10. Will YSI be required to perform feed control?

Yes If yes, number of pumps/vessel? _____ No

Note: YSI feed control systems provide setpoint (feedback) control using either a PID control loop or simple threshold algorithm. For other feed control options, the YSI analyzer data can be communicated directly to your bioreactor controller or SCADA system using an analog signal (0-5V), RS-232 communication or ethernet (FTP).

VESSEL INFORMATION

1. Type of bioreactor system:

Stainless steel stirred tank Glass stirred tank
 Single-use - stirred bag Single-use - wave bag
 Single-use - Other _____
 Airlift bioreactor Hollow Fiber Other

2. Make/Model of bioreactor system:

Sartorius Eppendorf/New Brunswick
 Eppendorf/Dasgip Applikon HyClone SUB/SUF GE/Excellerex
 Broadley-James Infors HT Other

3. Vessel Total Volume:

_____ L

4. How many vessels will be sampled?

1-4 4-8

5. What is the vessel sample port size and type?

12mm Headplate 19mm Headplate
 19mm Ingold
 25mm Ingold (standard - 40mm port depth)
 25mm Ingold (safety - 52mm port depth)
 Sanitary Fitting (1.5 inch tri-clamp)
Other _____

6. What type of sample interface will the vessel have?

Filtration Sample Probe (cell-free sampling)
 Dip Tube (cell-containing sampling)
Other _____

Note: As a best practice, YSI recommends the use of a filtration sample probe to prevent cell metabolism of the process sample as well as ensure bioreactor sterility.

7. What will be the maximum distance between the vessel and the YSI analyzer?

< 5 feet (1.5 meters) 5 - 10 feet (1.5 - 3 meters)
Other _____

8. What are the vessel sterilization/cleaning requirements?

Steam-in-place Clean-in-place Autoclave
Other _____

PROCESS ANALYTICAL INFORMATION

1. What analytes will be monitored by the YSI analyzer?

Check all that apply:

- Glucose Galactose Glutamine Choline
- Sucrose Xylose Ethanol Ammonium
- Fructose Lactate Methanol Potassium
- Lactose Glutamate Glycerol Hydrogen Peroxide

2. How frequently will the vessel need to be sampled?

- < 15 minutes 15 minutes 30 minutes 60 minutes
- 1 - 4 times per day

Other _____

3. Will manual samples be analyzed using the same instrument as the automated samples?

- Yes No

4. Will sample dilution be required prior to conducting sample analysis ?

- Yes No

5. If yes on #4, what dilution factor will be used?

Dilution factor = _____ X

DATA MANAGEMENT INFORMATION

1. What type of bioprocess management/SCADA system will be used for process monitoring and control?

- Sartorius BioPAT MFCS/win New Brunswick Biocommand
- Dasgip Dasware Applikon BioXpert Infors HT Delta V
- Other _____

2. Does the process management/SCADA system have an OPC server or OPC client?

- Yes - OPC Server Yes - OPC Client No

3. Does the process management/SCADA system have other I/O communication options?

- Yes - analog 0 - 5V Yes - RS - 232
- Yes - ethernet (TCP/IP or FTP)

4. Would you like the YSI analyzer to integrate the real-time analytical data into your bioprocess management or SCADA system?

- Yes No

Additional Comments



2900/2940



2950M



2900M

Order Guide

STEP 1 Complete Online Monitoring & Control Questionnaire

Completion of questionnaire assures correct YSI online monitoring system and configuration is ordered.

STEP 2 Order Online Monitoring System

All systems include required sample and communication interface hardware.

2900M: 1-channel online monitoring & control system for up to 2 chemistries. Includes 2900D, 2 Chemistry Analyzer, and 2960 online monitor & control accessory.

2950M: 1-channel online monitoring & control system for 2 - 6 chemistries. 2950D and 2960 must be ordered separately. *Refer to YSI Biochemistry Analyzer Selection Guide for 2950D configuration.*

2940: 4-channel online monitor system. Accessory may be interfaced with any 2900 Series analyzer. *Refer to YSI Biochemistry Analyzer Selection Guide for 2900D/2950D configuration.*

2980: 8-channel online monitor system. Accessory may be interfaced with any 2900 Series analyzer. *Refer to YSI Biochemistry Analyzer Selection Guide for 2900D/2950D configuration.*

STEP 3 Order Sample Tubing Set

Notes:

Tubing sets only required for 2940 and 2980 online monitoring systems.

Pre-sterilized tubing sets are gamma irradiated.

Consult Online Monitoring & Control Questionnaire to determine quantity and tubing length.

2981: Tubing Assembly, autoclaveable, 1.5 meter (5 feet).

2982: Tubing Assembly, pre-sterilized, 1.5 meter (5 feet).

2983: Tubing Assembly, autoclaveable, 3 meter (10 feet).

2984: Tubing Assembly, pre-sterilized, 3 meter (10 feet).



STEP 4 Order Sampling Probes

Notes:

FISP® in-situ sampling probes ensure bioreactor sterility and aseptic, cell-free sampling of bioreactor media. All FISP sampling probes are shipped completely assembled with 0.2 um ceramic membrane.

Consult Online Monitoring & Control Questionnaire to determine quantity and vessel port type, size and length.

For F-series FISP probes, the probe length is usually similar to the pH probe length used for the customer's bioreactor.

2854: D-series. Fits 25mm vessel port with 40mm depth.

2855: D-series. Fits 25mm vessel port with 52mm depth (safety ports).

2850: F-series. 120mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2 inch sanitary fitting adapter.

2851: F-series. 200mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2 inch sanitary fitting adapter.

2852: F-series. 310mm insertion length. Fits 12mm headplate port.

2853: F-series. 410mm insertion length. Fits 12mm headplate port.

STEP 5 Order Accessories

Notes:

Consult Online Monitoring & Control Questionnaire to determine quantity and accessory type. FISP probe starter kit is highly recommended.

2932: IQ/OQ Documentation Package, 2900

2925: OPC Server Software (required for OPC communication with 4-channel & 8-channel online monitoring systems)

2868: 12 -19mm Adapter for PG 13.5 fitting

2870: 1.5 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel

2871: 2 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel

2872: PG 13.5 Male Thread to 12mm Compression Fitting

Note: compression fitting allows user to manually adjust immersion depth of sampling probe. This is most commonly used with 2851 (200mm probe) and 2852 (310mm probe)

2858: D-series 25mm FISP Probe Starter Kit (includes (2) ceramic membranes, (10) 25 main shaft o-rings, (10) membrane shaft o-rings, (5) 10-32 PEEK nut/ferrule combo and (5) end cap screws.

2859: F-series FISP Probe Starter Kit (includes (2) ceramic membranes, (3) 12mm Teflon washers and o-rings, (10) membrane shaft o-rings, (5) 10-32 PEEK plugs, (5) 10-32 PEEK nut/ferrule combo and (5) end cap screws.

YSI Life Sciences Media



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YSI Life Sciences develops and manufactures scientific instruments, sensors and systems that serve a variety of scientific and industrial markets worldwide. YSI has a long history in the life sciences and bioanalytical markets, most notably with our introduction of the world's first commercial whole blood glucose analyzer in 1975. Today there are over 10,000 YSI instruments installed around the world, trusted in critical situations to provide the most accurate data in the shortest time.

For further information, please contact:

YSI Life Sciences

1725 Brannum Lane | Yellow Springs, Ohio 45387

Website: ysi.com | Email: support@ysi.com

Telephone: (937) 767-7241 | Fax: (937) 767-9320

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